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Gaia Rocchitta

University of Sassari, Italy

A study on the hypoglycemic effect of pomegranate and blueberry nutraceuticals in a model of intestinal absorption by means of electrochemical devices

Type 2 Diabetes Mellitus (T2DM) is one of the most common diseases involving hundreds of million people. T2DM has been shown to be associated to pancreatic dysfunctions and impaired glucose tolerance, both related to the production of reactive oxygen species due to fluctuations in blood glucose and hyperglycemia Nowadays, the management of hyperglycemia not only with pharmacological therapies is taking on relevance. Moreover, a continuous intake of polyphenols relates to health-promoting properties and it regulates blood glucose and controls oxidative stress. In the present study, a novel amperometric device is presented for the instantaneous monitoring of the impact of pomegranate and blueberry juices polyphenols on the glucose absorption through Caco-2TC7 monolayer cells. The system consists of laccase or tyrosinase-based and glucose biosensors allocated in the basal section of a culture plate. The space above the Caco-2TC7 cells simulates the intestinal lumen, while the basolater portion reflects the virtual bloodstream. The cell culture was treated with 1 mM glucose, the absorption of which was monitored in real-time by means of the glucose biosensor, showing a virtual bioavailability of about 5%. The use of Phlorizin and Phloretin, inhibitors of SGLT1 and GLUT1 Glucose Transporters, caused a lowering of 10 times on glucose bioavailability. By means of laccase or tyrosinase biosensor, it was also evaluated that the absorption of both drugs was very low (Phlorizin was about 0.13 % and of Phloretin about 0.49 %). The co-treatment with glucose and pomegranate and blueberry juices, containing rather high amounts of polyphenols (about 33% anthocyanins and about 53% anthocyanins), determined a sustained reduction in the glucose concentrations found in the basolateral compartment: blueberry or pomegranate juices treatment determined only about 0.2 % and 0.8% of glucose bioavailability respectively, showing a hypoglycemic effect on the monolayer. Polyphenols' concentrations were also evaluated, showing an effective transport through Caco-2-TC7 cell monolayer.

Biography

Gaia Rocchitta graduated in chemistry in 1999 with a thesis about polyphenols in red wines and then she completed her PhD in Neuroscience at School of Medicine of Sassari University (Italy) in 2004. She was a Postdoctoral fellow at School of Chemistry & Chemical Biology, University College, Dublin (Ireland) in 2006, working on the development of amperometric biosensors for in vivo-monitoring of neurochemical compounds. She currently is a tenured researcher and lecturer in Pharmacology and Nutraceutical at School of Medicine of Sassari University (Italy). She has published more than 50 papers in peer-reviewed journals.

grocchitta@uniss.it

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